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18PHY12/22

# First/Second er B.E. Degree Examination, Dec.2019/Jan.2020
## Engineering Physics

Time: 3 hrs. Max. Marks: 100

**Note: 1.** *Answer any FIVE full questions, choosing ONE full question from each module.*
*2. Physical constants : velocity of light C = 3 x $10^8$ m/s; Planck's constant h = 6.63 x $10^{-34}$ .1-5$^{l}$ : Mass of an electron in = 9.11 x $10^{-31}$ kg Beltzmann constant K = 1.38 x $10^{-23}$ f/K; Avagadro number NA = 6.02 x $10^{26}$/K mole.*

### Module-1

1 a. Give the theory of forced vibrations and obtain the expression for amplitude. **(08 Marks)**
b. With a neat diagram, explain the construction and working of Reddy tube. Mention four applications of shock waves. **(08 Marks)**
c. Calculate the resonant frequency for a simple pendulum of length lm. **(04 Marks)**

**OR**

2 a. Define force constant and mention its physical significance. Derive the expression for force constant for springs in series and parallel combination. **(08 Marks)**
b. Define simple harmonic motion. Derive the differential equation of motion for it using Hook's law. Mention the characteristics and examples of simple harmonic motion. **(08 Marks)**
c. The distance between the two pressure sensors in a shock tube is 150mm. The time taken by a shock wave to travel this distance is 0.3ms. If the velocity of sound under the same condition is 340m/s. Find the Mach number of the shock wave. **(04 Marks)**

### Module-2

3 a. Explain longitudinal stress, longitudinal strain, volume stress and volume strain. Discuss the effect of stress, temperature, annealing and impurities on elasticity. **(08 Marks)**
b. Derive the relation between bulk modulus(k), Young's modulus (Y) and Poisson's ratio (a), what are the limiting values of Poisson's ratio? **(08 Marks)**
c. Calculate the extension produced in a wire of length 2m and radius 0.013 x $10^{-2}$ m due to a force of 14.7 Newton applied along its length. Given, Young's modulus of the material of the wire Y = 2.1 x $10^{11}$ N/m$^2$. **(04 Marks)**

**OR**

4 a. Describe a single cantilever and derive the expression for Young's modulus of the material of rectangular beam. **(08 Marks)**
b. Derive an expression for couple per unit twist for a solid cylinder with a diagram. **(08 Marks)**
c. Calculate the angular twist of a wire of length 0.3m and radius 0.2 x $10^{3}$m when a torque of 5 x $10^{4}$ Nm is applied. (Rigidity modulus of the martial is 8 x $10^{1°}$ N/m$^2$). **(04 Marks)**

### Module-3

5 a. Explain Divergence and curl. Derive Gauss Divergence theorem. **(08 Marks)**
b. Define V-number and fractional index change. With a neat diagrams, explain different types of optical fibers. **(08 Marks)**
c. Find the divergence of the vector field A given by X = 6x$^2$ a x + 3xy$^2$ a y+ xyz$^{3}$ az at a point P(1, 3, 6). **(04 Marks)**

**OR**

6 a. Derive the expression for displacement current. Mention 4 Maxwell's equations in differential form for time varying fields. **(08 Marks)**

b. Derive an expression for numerical aperture in an optical fiber and stain the condition for propagation. **(08 Marks)**

c. Find the attenuation in an optical fiber of length 500m When a light signal of power 100mw emerges out of the fiber with a power 90mw. **(04 Marks)**

## Module-4

7 a. State and explain Heisenberg's Uncertainty Principle. Show that the electron cannot exist inside the nucleus. **(08 Marks)**

b. Define spontaneous emission and stimulated emission. Explain the construction and working semiconductor Laser. **(08 Marks)**

c. A partied of mass $0.5mev/C^2$ has kinetic energy 100eV. Find its de Broglie wavelength, where C is the velocity of light. **(04 Marks)**

**OR**

8 a. Assuming the time independent SchrOdinger wave equation, discuss the solution for a particle in one dimensional potential well of infinite height. Hence obtain the normalized wave function. **(08 Marks)**

b. Derive the expression for energy density interms Eienstein's co-efficient. **(08 Marks)**

c. The ratio of population of two energy levels is $1.059 \times 10'^{\circ}$. Find the wavelength of light emitted by spontaneous emissions at 330K. **(04 Marks)**

## Module-5

9 a. Give the assumptions of quantum free electron theory. Discuss two success of quantum free electron theory. **(08 Marks)**

b. What are polar and non-polar dielectrics? Explain types of polarization. **(08 Marks)**

C. Calculate the probability of an electron occupying an energy level 0.02ev above the Fermi level at 200K and 400K in a material. **(04 Marks)**

**OR**

10 a. Define internal field. Mention the expressions for internal field, for one dimension, for thre dimensional, and Lorentz field for dialectics. Derive Clausius Morsotti equation. **(08 Marks)**

b. Describe Fermi level in an intrinsic semi conductor and hence obtain the expression for Fermi energy in terms of energy gap of intrinsic semiconductor. **(08 Marks)**

c. An elemental solid dielectric material has polarizability $7 \times 10^{-40} Fm^2$. Assuming the internal field to be Lorentz field, calculate the dielectric constant for the material if the material has $3 \times 10^{28}$ atoms/$m^3$. **(04 Marks)**